Figure 1. *H. grisea* GSHE nucleotide sequence with *putative* introns bold & underlined.

ATGCATACCTTCTCCAAGCTCCTCGTCCTGGGCTCTGCCGTCCAGTCTGCCCTCGGGCGGCCTCACGGCTCT
TCGCGTCTCCAGGAACGCGCTGCCGTTGATACCTTCATCAACACCGAGAAGCCCATCGCATGGAACAAGCTG
CTCGCCAACATCGGCCCTAACGGCAAAGCCGCTCCCGGTGCCGCCGCCGGCGTTGTGATTGCCAGCCCTTCC
AGGACGGACCCTCCTT**GTACGTGGTGGCATGGAATGGACCCAAGAGACTGGTTTTAGATGAAAGAGAGTTTC**
TGCTAACCGCCACACCCAGACTTCTTCACCTGGACCCGCGATGCCGCCCTGGTCCTCACCGGCATCATCGAG
TCCCTTGGCCACAACTACAACACCACCCTGCAGACCGTCATCCAGAACTACGTCGCGTCGCAGGCCAAGCTG
CAGCAGGTCTCGAACCCCTCGGGAACCTTCGCCGACGGCTCGGGTCTCGGTGAGGCCAAGTTCAATGTCGAC
CTCACTGCCTTCACTGGCGAATGGGGTCGCCCTCAGAGGGACGGCCCGCCCCTGCGCGCCATCGCTCTCATC
CAGTACGCCAAGTGGCTGATCGCCAACGGCTACAAGAGCACGGCCAAGAGCGTCGTCTGGCCCGTCGTCAAG
AACGATCTCGCCTACACGGCCCAGTACTGGAACGAGACCGGCTTCGATCTCTGGGAGGAGGTCCCCGGCAGC
TCGTTCTTTACCATCGCCAGCTCTCACAGGG**GTGAGTCATTTATTGTTCAGTGTTTTCTCATTGAATAATTA**
CCGGAATGCCACTGACGCCAAACAGCTCTGACTGAGGGTGCTTACCTCGCCGCTCAGCTCGACACCGAGTGC
CGCGCCTGCACGACCGTCGCCCCTCAGGTTCTGTGCTTCCAGCAGGCCTTCTGGAACTCCAAGGGCAACTAT
GTCGTCTCCAACA**GTAAGATCCCTACACCAACAAAAAAAATCGAAAAGGAACGTTAGCTGACCCTTCTAG**TC
AACGGCGGCGAGTATCGCTCCGGCAAGGACGCCAACTCGATCCTGGCGTCCATCCACAACTTCGACCCTGAG
GCCGGCTGCGACAACCTGACCTTCCAGCCCTGCAGCGAGCGCGCCCTGGCCAACCACAAGGCCTATGTCGAC
TCGTTCCGCAACCTCTACGCCATCAACAAGGGCATCGCCCAGGGCAAGGCCGTTGCCGTCGGCCGCTACTCG
GAGGATGTCTACTACAACGGCAACCCGTGGTACCTGGCCAACTTTGCCGCCGCCGAGCAGCTCTACGACGCC
ATCTACGTGTGGAACAAGCAGGGCTCCATCACCGTGACCTCGGTCTCCCTGCCCTTCTTCCGCGACCTTGTC
TCGTCGGTCAGCACCGGCACCTACTCCAAGAGCAGCTCGACCTTCACCAACATCGTCAACGCCGTCAAGGCC
TACGCCGACGGCTTCATCGAGGTGGCGGCCAAGTACACCCCGTCCAACGGCGCGCTCGCCGAGCAGTACGAC
CGCAACACGGGCAAGCCCGACTCGGCCGCCGACCTGACGTGGTCGTACTCGGCCTTCCTCTCGGCCATCGAC
CGCCGCGCGGGTCTCGTCCCCCCGAGCTGGCGGGCCAGCGTGGCCAAGAGCCAGCTGCCGTCCACCTGCTCG
CGCATCGAGGTCGCCGGCACCTACGTCGCCGCCACGAGCACCTCGTTCCCGTCCAAGCAGACCCCGAACCCC
TCCGCGGCGCCCTCCCCGTCCCCCTACCCGACCGCCTGCGCGGACGCTAGCGAGGTGTACGTCACCTTCAAC
GAGCGCGTGTCGACCGCGTGGGGCGAGACCATCAAGGTGGTGGGCAACGTGCCGGCGCTGGGGAACTGGGAC
ACGTCCAAGGCGGTGACCCTGTCGGCCAGCGGGTACAAGTCGAATGATCCCCTCTGGAGCATCACGGTGCCC
ATCAAGGCGACGGGCTCGGCCGTGCAGTACAAGTATATCAAGGTCGGCACCAACGGGAAGATTACTTGGGAG
TCGGACCCCAACAGGAGCATTACCCTGCAGACGGCGTCGTCTGCGGGCAAGTGCGCCGCGCAGACGGTGAAT
GATTCGTGGCGTTAA

Figure 2A. *H. grisea* GSHE protein sequence with *putative* signal sequence underlined.

M H T F S K L L V L G S A V Q S A L G R P H G S S R L Q E R A A V D T F I N T E
K P I A W N K L L A N I G P N G K A A P G A A A G V V I A S P S R T D P P Y F F
T W T R D A A L V L T G I I E S L G H N Y N T T L Q T V I Q N Y V A S Q A K L Q
Q V S N P S G T F A D G S G L G E A K F N V D L T A F T G E W G R P Q R D G P P
L R A I A L I Q Y A K W L I A N G Y K S T A K S V V W P V V K N D L A Y T A Q Y
W N E T G F D L W E E V P G S S F F T I A S S H R A L T E G A Y L A A Q L D T E
C R A C T T V A P Q V L C F Q Q A F W N S K G N Y V V S N I N G G E Y R S G K D
A N S I L A S I H N F D P E A G C D N L T F Q P C S E R A L A N H K A Y V D S F
R N L Y A I N K G I A Q G K A V A V G R Y S E D V Y Y N G N P W Y L A N F A A A
E Q L Y D A I Y V W N K Q G S I T V T S V S L P F F R D L V S S V S T G T Y S K
S S S T F T N I V N A V K A Y A D G F I E V A A K Y T P S N G A L A E Q Y D R N
T G K P D S A A D L T W S Y S A F L S A I D R R A G L V P P S W R A S V A K S Q
L P S T C S R I E V A G T Y V A A T S T S F P S K Q T P N P S A A P S P S P Y P
T A C A D A S E V Y V T F N E R V S T A W G E T I K V V G N V P A L G N W D T S
K A V T L S A S G Y K S N D P L W S I T V P I K A T G S A V Q Y K Y I K V G T N
G K I T W E S D P N R S I T L Q T A S S A G K C A A Q T V N D S W R

Figure 2B. *H. grisea* Mature GSHE protein sequence

A A V D T F I N T E K P I A W N K L L A N I G P N G K A A P G A A A G V V I A S
P S R T D P P Y F F T W T R D A A L V L T G I I E S L G H N Y N T T L Q T V I Q
N Y V A S Q A K L Q Q V S N P S G T F A D G S G L G E A K F N V D L T A F T G E
W G R P Q R D G P P L R A I A L I Q Y A K W L I A N G Y K S T A K S V V W P V V
K N D L A Y T A Q Y W N E T G F D L W E E V P G S S F F T I A S S H R A L T E G
A Y L A A Q L D T E C R A C T T V A P Q V L C F Q Q A F W N S K G N Y V V S N I
N G G E Y R S G K D A N S I L A S I H N F D P E A G C D N L T F Q P C S E R A L
A N H K A Y V D S F R N L Y A I N K G I A Q G K A V A V G R Y S E D V Y Y N G N
P W Y L A N F A A A E Q L Y D A I Y V W N K Q G S I T V T S V S L P F F R D L V
S S V S T G T Y S K S S S T F T N I V N A V K A Y A D G F I E V A A K Y T P S N
G A L A E Q Y D R N T G K P D S A A D L T W S Y S A F L S A I D R R A G L V P P
S W R A S V A K S Q L P S T C S R I E V A G T Y V A A T S T S F P S K Q T P N P
S A A P S P S P Y P T A C A D A S E V Y V T F N E R V S T A W G E T I K V V G N
V P A L G N W D T S K A V T L S A S G Y K S N D P L W S I T V P I K A T G S A V
Q Y K Y I K V G T N G K I T W E S D P N R S I T L Q T A S S A G K C A A Q T V N
D S W R

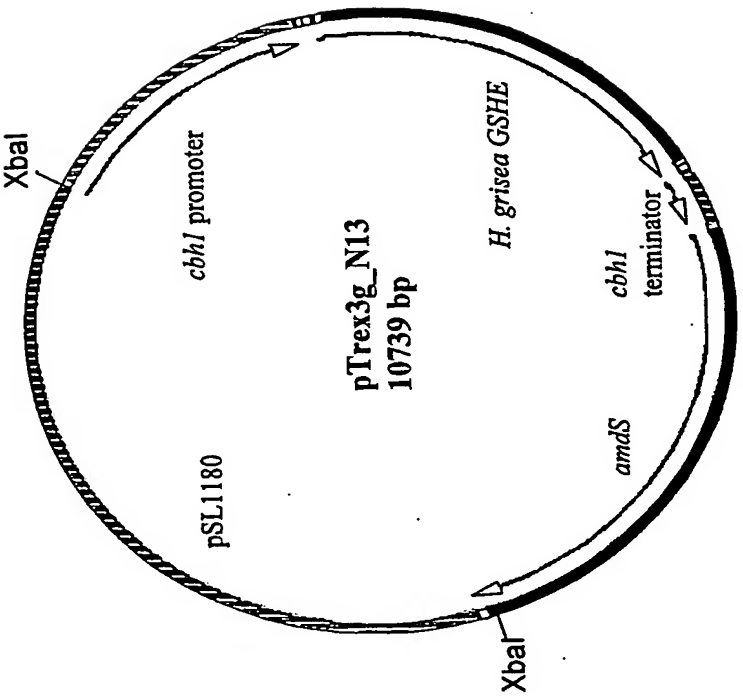
XbaI
cbh1 promoter
H. grisea GSHE
cbh1 terminator
pTrex3g_N13
10739 bp
pSL1180
amdS
XbaI

Figure 3.

FIGURE 4A

AAGCTTACTAGTACTTCTCGAGCTCTGTACATGTCCGGTCGCGACGTACGCGTATCGATGGCGCCAGCTG
CAGGCGGCCGCCTGCAGCCACTTGCAGTCCCGTGGAATTCTCACGGTGAATGTAGGCCTTTTGTAGGGTA
GGAATTGTCACTCAAGCACCCCCAACCTCCATTACGCCTCCCCCATAGAGTTCCCAATCAGTGAGTCATG
GCACTGTTCTCAAATAGATTGGGGAGAAGTTGACTTCCGCCCAGAGCTGAAGGTCGCACAACCGCATGAT
ATAGGGTCGGCAACGGCAAAAAAGCACGTGGCTCACCGAAAAGCAAGATGTTTGCGATCTAACATCCAGG
AACCTGGATACATCCATCATCACGCACGACCACTTTGATCTGCTGGTAAACTCGTATTCGCCCTAAACCG
AAGTGCGTGGTAAATCTACACGTGGGCCCCTTTCGGTATACTGCGTGTGTCTTCTCTAGGTGCCATTCTT
TTCCCTTCCTCTAGTGTTGAATTGTTTGTGTTGGAGTCCGAGCTGTAACTACCTCTGAATCTCTGGAGAA
TGGTGGACTAACGACTACCGTGCACCTGCATCATGTATATAATAGTGATCCTGAGAAGGGGGGTTTGGAG
CAATGTGGGACTTTGATGGTCATCAAACAAAGAACGAAGACGCCTCTTTTGCAAAGTTTTGTTTCGGCTA
CGGTGAAGAACTGGATACTTGTTGTGTCTTCTGTGTATTTTTGTGGCAACAAGAGGCCAGAGACAATCTA
TTCAAACACCAAGCTTGCTCTTTTGAGCTACAAGAACCTGTGGGGTATATATCTAGAGTTGTGAAGTCGG
TAATCCCGCTGTATAGTAATACGAGTCGCATCTAAATACTCCGAAGCTGCTGCGAACCCGGAGAATCGAG
ATGTGCTGGAAAGCTTCTAGCGAGCGGCTAAATTAGCATGAAAGGCTATGAGAAATTCTGGAGACGGCTT
GTTGAATCATGGCGTTCCATTCTTCGACAAGCAAAGCGTTCCGTCGCAGTAGCAGGCACTCATTCCCGAA
AAAACTCGGAGATTCCTAAGTAGCGATGGAACCGGAATAATATAATAGGCAATACATTGAGTTGCCTCGA
CGGTTGCAATGCAGGGGTACTGAGCTTGGACATAACTGTTCCGTACCCCACCTCTTCTCAACCTTTGGCG
TTTCCCTGATTCAGCGTACCCGTACAAGTCGTAATCACTATTAACCCAGACTGACCGGACGTGTTTTGCC
CTTCATTTGGAGAAATAATGTCATTGCGATGTGTAATTTGCCTGCTTGACCGACTGGGGCTGTTCGAAGC
CCGAATGTAGGATTGTTATCCGAACTCTGCTCGTAGAGGCATGTTGTGAATCTGTGTCGGGCAGGACACG
CCTCGAAGGTTCACGGCAAGGGAAACCACCGATAGCAGTGTCTAGTAGCAACCTGTAAAGCCGCAATGCA
GCATCACTGGAAAATACAAACCAATGGCTAAAAGTACATAAGTTAATGCCTAAAGAAGTCATATACCAGC
GGCTAATAATTGTACAATCAAGTGGCTAAACGTACCGTAATTTGCCAACGGCTTGTGGGGTTGCAGAAGC
AACGGCAAAGCCCCACTTCCCCACGTTTGTTTCTTCACTCAGTCCAATCTCAGCTGGTGATCCCCCAATT
GGGTCGCTTGTTTGTTCCGGTGAAGTGAAAGAAGACAGAGGTAAGAATGTCTGACTCGGAGCGTTTTGCA
TACAACCAAGGGCAGTGATGGAAGACAGTGAAATGTTGACATTCAAGGAGTATTTAGCCAGGGATGCTTG
AGTGTATCGTGTAAGGAGGTTTGTCTGCCGATACGACGAATACTGTATAGTCACTTCTGATGAAGTGGTC
CATATTGAAATGTAAAGTCGGCACTGAACAGGCAAAAGATTGAGTTGAAACTGCCTAAGATCTCGGGCCC
TCGGGCCTTCGGCCTTTGGGTGTACATGTTTGTGCTCCGGGCAAATGCAAAGTGTGGTAGGATCGAACAC
ACTGCTGCCTTTACCAAGCAGCTGAGGGTATGTGATAGGCAAATGTTCAGGGGCCACTGCATGGTTTCGA
ATAGAAAGAGAAGCTTAGCCAAGAACAATAGCCGATAAAGATAGCCTCATTAAACGGAATGAGCTAGTAG

FIGURE 4B

GCAAAGTCAGCGAATGTGTATATATAAAGGTTCGAGGTCCGTGCCTCCCTCATGCTCTCCCCATCTACTC
ATCAACTCAGATCCTCCAGGAGACTTGTACACCATCTTTTGAGGCACAGAAACCCAATAGTCAACCATCA
CAAGTTTGTACAAAAAAGCAGGCTCCGCGGCCGCCCCCTTCAACATGCATACCTTCTCCAAGCTCCTCGT
CCTGGGCTCTGCCGTCCAGTCTGCCCTCGGGCGGCCTCACGGCTCTTCGCGTCTCCAGGAACGCGCTGCC
GTTGATACCTTCATCAACACCGAGAAGCCCATCGCATGGAACAAGCTGCTCGCCAACATCGGCCCTAACG
GCAAAGCCGCTCCCGGTGCCGCCGCCGGCGTTGTGATTGCCAGCCCTTCCAGGACGGACCCTCCTTGTAC
GTGGTGGCATGGAATGGACCCAAGAGACTGGTTTTAGATGAAAGAGAGTTTCTGCTAACCGCCACACCCA
GACTTCTTCACCTGGACCCGCGATGCCGCCCTGGTCCTCACCGGCATCATCGAGTCCCTTGGCCACAACT
ACAACACCACCCTGCAGACCGTCATCCAGAACTACGTCGCGTCGCAGGCCAAGCTGCAGCAGGTCTCGAA
CCCCTCGGGAACCTTCGCCGACGGCTCGGGTCTCGGTGAGGCCAAGTTCAATGTCGACCTCACTGCCTTC
ACTGGCGAATGGGGTCGCCCTCAGAGGGACGGCCCGCCCCTGCGCGCCATCGCTCTCATCCAGTACGCCA
AGTGGCTGATCGCCAACGGCTACAAGAGCACGGCCAAGAGCGTCGTCTGGCCCGTCGTCAAGAACGATCT
CGCCTACACGGCCCAGTACTGGAACGAGACCGGCTTCGATCTCTGGGAGGAGGTCCCCGGCAGCTCGTTC
TTTACCATCGCCAGCTCTCACAGGGGTGAGTCATTTATTGTTCAGTGTTTTCTCATTGAATAATTACCGG
AATGCCACTGACGCCAAACAGCTCTGACTGAGGGTGCTTACCTCGCCGCTCAGCTCGACACCGAGTGCCG
CGCCTGCACGACCGTCGCCCCTCAGGTTCTGTGCTTCCAGCAGGCCTTCTGGAACTCCAAGGGCAACTAT
GTCGTCTCCAACAGTAAGATCCCTACACCAACAAAAAAAATCGAAAAGGAACGTTAGCTGACCCTTCTAG
TCAACGGCGGCGAGTATCGCTCCGGCAAGGACGCCAACTCGATCCTGGCGTCCATCCACAACTTCGACCC
TGAGGCCGGCTGCGACAACCTGACCTTCCAGCCCTGCAGCGAGCGCGCCCTGGCCAACCACAAGGCCTAT
GTCGACTCGTTCCGCAACCTCTACGCCATCAACAAGGGCATCGCCCAGGGCAAGGCCGTTGCCGTCGGCC
GCTACTCGGAGGATGTCTACTACAACGGCAACCCGTGGTACCTGGCCAACTTTGCCGCCGCCGAGCAGCT
CTACGACGCCATCTACGTGTGGAACAAGCAGGGCTCCATCACCGTGACCTCGGTCTCCCTGCCCTTCTTC
CGCGACCTTGTCTCGTCGGTCAGCACCGGCACCTACTCCAAGAGCAGCTCGACCTTCACCAACATCGTCA
ACGCCGTCAAGGCCTACGCCGACGGCTTCATCGAGGTGGCGGCCAAGTACACCCCGTCCAACGGCGCGCT
CGCCGAGCAGTACGACCGCAACACGGGCAAGCCCGACTCGGCCGCCGACCTGACGTGGTCGTACTCGGCC
TTCCTCTCGGCCATCGACCGCCGCGCGGGTCTCGTCCCCCCGAGCTGGCGGGCCAGCGTGGCCAAGAGCC
AGCTGCCGTCCACCTGCTCGCGCATCGAGGTCGCCGGCACCTACGTCGCCGCCACGAGCACCTCGTTCCC
GTCCAAGCAGACCCCGAACCCCTCCGCGGCGCCCTCCCCGTCCCCCTACCCGACCGCCTGCGCGGACGCT
AGCGAGGTGTACGTCACCTTCAACGAGCGCGTGTCGACCGCGTGGGGCGAGACCATCAAGGTGGTGGGCA
ACGTGCCGGCGCTGGGGAACTGGGACACGTCCAAGGCGGTGACCCTGTCGGCCAGCGGGTACAAGTCGAA
TGATCCCCTCTGGAGCATCACGGTGCCCATCAAGGCGACGGGCTCGGCCGTGCAGTACAAGTATATCAAG

FIGURE 4C

GTCGGCACCAACGGGAAGATTACTTGGGAGTCGGACCCCAACAGGAGCATTACCCTGCAGACGGCGTCGT
CTGCGGGCAAGTGCGCCGCGCAGACGGTGAATGATTCGTGGCGTTAAAAGGGTGGGCGCGCCGACCCAGC
TTTCTTGTACAAAGTGGTGATCGCGCCAGCTCCGTGCGAAAGCCTGACGCACCGGTAGATTCTTGGTGAG
CCCGTATCATGACGGCGGCGGGAGCTACATGGCCCCGGGTGATTTATTTTTTTTGTATCTACTTCTGACC
CTTTTCAAATATACGGTCAACTCATCTTTCACTGGAGATGCGGCCTGCTTGGTATTGCGATGTTGTCAGC
TTGGCAAATTGTGGCTTTCGAAAACACAAAACGATTCCTTAGTAGCCATGCATTTTAAGATAACGGAATA
GAAGAAAGAGGAAATTAAAAAAAAAAAAAAAAACAAACATCCCGTTCATAACCCGTAGAATCGCCGCTCTT
CGTGTATCCCAGTACCAGTTTATTTTGAATAGCTCGCCCGCTGGAGAGCATCCTGAATGCAAGTAACAAC
CGTAGAGGCTGACACGGCAGGTGTTGCTAGGGAGCGTCGTGTTCTACAAGGCCAGACGTCTTCGCGGTTG
ATATATATGTATGTTTGACTGCAGGCTGCTCAGCGACGACAGTCAAGTTCGCCCTCGCTGCTTGTGCAAT
AATCGCAGTGGGGAAGCCACACCGTGACTCCCATCTTTCAGTAAAGCTCTGTTGGTGTTTATCAGCAATA
CACGTAATTTAAACTCGTTAGCATGGGGCTGATAGCTTAATTACCGTTTACCAGTGCCATGGTTCTGCAG
CTTTCCTTGGCCCGTAAAATTCGGCGAAGCCAGCCAATCACCAGCTAGGCACCAGCTAAACCCTATAATT
AGTCTCTTATCAACACCATCCGCTCCCCCGGGATCAATGAGGAGAATGAGGGGGATGCGGGGCTAAAGAA
GCCTACATAACCCTCATGCCAACTCCCAGTTTACACTCGTCGAGCCAACATCCTGACTATAAGCTAACAC
AGAATGCCTCAATCCTGGGAAGAACTGGCCGCTGATAAGCGCGCCCGCCTCGCAAAAACCATCCCTGATG
AATGGAAAGTCCAGACGCTGCCTGCGGAAGACAGCGTTATTGATTTCCCAAAGAAATCGGGGATCCTTTC
AGAGGCCGAACTGAAGATCACAGAGGCCTCCGCTGCAGATCTTGTGTCCAAGCTGGCGGCCGGAGAGTTG
ACCTCGGTGGAAGTTACGCTAGCATTCTGTAAACGGGCAGCAATCGCCCAGCAGTTAGTAGGGTCCCCTC
TACCTCTCAGGGAGATGTAACAACGCCACCTTATGGGACTATCAAGCTGACGCTGGCTTCTGTGCAGACA
AACTGCGCCCACGAGTTCTTCCCTGACGCCGCTCTCGCGCAGGCAAGGGAACTCGATGAATACTACGCAA
AGCACAAGAGACCCGTTGGTCCACTCCATGGCCTCCCCATCTCTCTCAAAGACCAGCTTCGAGTCAAGGT
ACACCGTTGCCCCTAAGTCGTTAGATGTCCCTTTTTGTCAGCTAACATATGCCACCAGGGCTACGAAACA
TCAATGGGCTACATCTCATGGCTAAACAAGTACGACGAAGGGGACTCGGTTCTGACAACCATGCTCCGCA
AAGCCGGTGCCGTCTTCTACGTCAAGACCTCTGTCCCGCAGACCCTGATGGTCTGCGAGACAGTCAACAA
CATCATCGGGCGCACCGTCAACCCACGCAACAAGAACTGGTCGTGCGGCGGCAGTTCTGGTGGTGAGGGT
GCGATCGTTGGGATTCGcRVTGGTGGCGTCATCGGTGTAGGAACGGATATCGGTGGCTCGATTCGAGTGC
CGGCCGCGTTCAACTTCCTGTACGGTCTAAGGCCGAGTCATGGGCGGCTGCCGTATGCAAAGATGGCGAA
CAGCATGGAGGGTCAGGAGACGGTGCACAGCGTTGTCGGGCCGATTACGCACTCTGTTGAGGGTGAGTCC
TTCGCCTCTTCCTTCTTTTCCTGCTCTATACCAGGCCTCCACTGTCCTCCTTTCTTGCTTTTTATACTAT
ATACGAGACCGGCAGTCACTGATGAAGTATGTTAGACCTCCGCCTCTTCACCAAATCCGTCCTCGGTCAG

FIGURE 4D

GAGCCATGGAAATACGACTCCAAGGTCATCCCCATGCCCTGGCGCCAGTCCGAGTCGGACATTATTGCCT
CCAAGATCAAGAACGGCGGGCTCAATATCGGCTACTACAACTTCGACGGCAATGTCCTTCCACACCCTCC
TATCCTGCGCGGCGTGGAAACCACCGTCGCCGCACTCGCCAAAGCCGGTCACACCGTGACCCCGTGGACG
CCATACAAGCACGATTTCGGCCACGATCTCATCTCCCATATCTACGCGGCTGACGGCAGCcRVGCCGACG
TAATGCGCGATATCAGTGCATCCGGCGAGCCGGCGATTCCAAATATCAAAGACCTACTGAACCCGAACAT
CAAAGCTGTTAACATGAACGAGCTCTGGGACACGCATCTCCAGAAGTGGAATTACCAGATGGAGTACCTT
GAGAAATGGCGGGAGGCTGAAGAAAAGGCCGGGAAGGAACTGGACGCCATCATCGCGCCGATTACGCCTA
CCGCTGCGGTACGGCATGACCAGTTCCGGTACTATGGGTATGCCTCTGTGATCAACCTGCTGGATTTCAC
GAGCGTGGTTGTTCCGGTTACCTTTGCGGATAAGAACATCGATAAGAAGAATGAGAGTTTCAAGGCGGTT
AGTGAGCTTGATGCCCTCGTGCAGGAAGAGTATGATCCGGAGGCGTACCATGGGGCACCGGTTGCAGTGC
AGGTTATCGGACGGAGACTCAGTGAAGAGAGGACGTTGGCGATTGCAGAGGAAGTGGGGAAGTTGCTGGG
AAATGTGGTGACTCCATAGCTAATAAGTGTCAGATAGCAATTTGCACAAGAAATCAATACCAGCAACTGT
AAATAAGCGCTGAAGTGACCATGCCATGCTACGAAAGAGCAGAAAAAAACCTGCCGTAGAACCGAAGAGA
TATGACACGCTTCCATCTCTCAAAGGAAGAATCCCTTCAGGGTTGCGTTTCCAGTCTAGACACGTATAAC
GGCACAAGTGTCTCTCACCAAATGGGTTATATCTCAAATGTGATCTAAGGATGGAAAGCCCAGAATATCG
ATCGCGCGCAGATCCATATATAGGGCCCGGGTTATAATTACCTCAGGTCGACGTCCCATGGCCATTCGAA
TTCGTAATCATGGTCATAGCTGTTTCCTGTGTGAAATTGTTATCCGCTCACAATTCCACACAACATACGA
GCCGGAAGCATAAAGTGTAAAGCCTGGGGTGCCTAATGAGTGAGCTAACTCACATTAATTGCGTTGCGCT
CACTGCCCGCTTTCCAGTCGGGAAACCTGTCGTGCCAGCTGCATTAATGAATCGGCCAACGCGCGGGGAG
AGGCGGTTTGCGTATTGGGCGCTCTTCCGCTTCCTCGCTCACTGACTCGCTGCGCTCGGTCGTTCGGCTG
CGGCGAGCGGTATCAGCTCACTCAAAGGCGGTAATACGGTTATCCACAGAATCAGGGGATAACGCAGGAA
AGAACATGTGAGCAAAAGGCCAGCAAAAGGCCAGGAACCGTAAAAAGGCCGCGTTGCTGGCGTTTTTCCA
TAGGCTCCGCCCCCCTGACGAGCATCACAAAAATCGACGCTCAAGTCAGAGGTGGCGAAACCCGACAGGA
CTATAAAGATACCAGGCGTTTCCCCCTGGAAGCTCCCTCGTGCGCTCTCCTGTTCCGACCCTGCCGCTTA
CCGGATACCTGTCCGCCTTTCTCCCTTCGGGAAGCGTGGCGCTTTCTCATAGCTCACGCTGTAGGTATCT
CAGTTCGGTGTAGGTCGTTCGCTCCAAGCTGGGCTGTGTGCACGAACCCCCCGTTCAGCCCGACCGCTGC
GCCTTATCCGGTAACTATCGTCTTGAGTCCAACCCGGTAAGACACGACTTATCGCCACTGGCAGCAGCCA
CTGGTAACAGGATTAGCAGAGCGAGGTATGTAGGCGGTGCTACAGAGTTCTTGAAGTGGTGGCCTAACTA
CGGCTACACTAGAAGAACAGTATTTGGTATCTGCGCTCTGCTGAAGCCAGTTACCTTCGGAAAAAGAGTT
GGTAGCTCTTGATCCGGCAAACAAACCACCGCTGGTAGCGGTGGTTTTTTTGTTTGCAAGCAGCAGATTA
CGCGCAGAAAAAAAGGATCTCAAGAAGATCCTTTGATCTTTTCTACGGGGTCTGACGCTCAGTGGAACGA

FIGURE 4E

AAACTCACGTTAAGGGATTTTGGTCATGAGATTATCAAAAAGGATCTTCACCTAGATCCTTTTAAATTAA
AAATGAAGTTTTAAATCAATCTAAAGTATATATGAGTAAACTTGGTCTGACAGTTACCAATGCTTAATCA
GTGAGGCACCTATCTCAGCGATCTGTCTATTTCGTTCATCCATAGTTGCCTGACTCCCCGTCGTGTAGAT
AACTACGATACGGGAGGGCTTACCATCTGGCCCCAGTGCTGCAATGATACCGCGAGACCCACGCTCACCG
GCTCCAGATTTATCAGCAATAAACCAGCCAGCCGGAAGGGCCGAGCGCAGAAGTGGTCCTGCAACTTTAT
CCGCCTCCATCCAGTCTATTAATTGTTGCCGGGAAGCTAGAGTAAGTAGTTCGCCAGTTAATAGTTTGCG
CAACGTTGTTGCCATTGCTACAGGCATCGTGGTGTCACGCTCGTCGTTTGGTATGGCTTCATTCAGCTCC
GGTTCCCAACGATCAAGGCGAGTTACATGATCCCCCATGTTGTGCAAAAAAGCGGTTAGCTCCTTCGGTC
CTCCGATCGTTGTCAGAAGTAAGTTGGCCGCAGTGTTATCACTCATGGTTATGGCAGCACTGCATAATTC
TCTTACTGTCATGCCATCCGTAAGATGCTTTTCTGTGACTGGTGAGTACTCAACCAAGTCATTCTGAGAA
TAGTGTATGCGGCGACCGAGTTGCTCTTGCCCGGCGTCAATACGGGATAATACCGCGCCACATAGCAGAA
CTTTAAAAGTGCTCATCATTGGAAAACGTTCTTCGGGGCGAAAACTCTCAAGGATCTTACCGCTGTTGAG
ATCCAGTTCGATGTAACCCACTCGTGCACCCAACTGATCTTCAGCATCTTTTACTTTCACCAGCGTTTCT
GGGTGAGCAAAAACAGGAAGGCAAAATGCCGCAAAAAAGGGAATAAGGGCGACACGGAAATGTTGAATAC
TCATACTCTTCCTTTTTCAATATTATTGAAGCATTTATCAGGGTTATTGTCTCATGAGCGGATACATATT
TGAATGTATTTAGAAAAATAAACAAATAGGGGTTCCGCGCACATTTCCCCGAAAAGTGCCACCTGACGTC
TAAGAAACCATTATTATCATGACATTAACCTATAAAAATAGGCGTATCACGAGGCCCTTTCGTCTCGCGC
GTTTCGGTGATGACGGTGAAAACCTCTGACACATGCAGCTCCCGGAGACGGTCACAGCTTGTCTGTAAGC
GGATGCCGGGAGCAGACAAGCCCGTCAGGGCGCGTCAGCGGGTGTTGGCGGGTGTCGGGGCTGGCTTAAC
TATGCGGCATCAGAGCAGATTGTACTGAGAGTGCACCATAAAATTGTAAACGTTAATATTTTGTTAAAAT
TCGCGTTAAATTTTTGTTAAATCAGCTCATTTTTTAACCAATAGGCCGAAATCGGCAAAATCCCTTATAA
ATCAAAAGAATAGCCCGAGATAGGGTTGAGTGTTGTTCCAGTTTGGAACAAGAGTCCACTATTAAAGAAC
GTGGACTCCAACGTCAAAGGGCGAAAAACCGTCTATCAGGGCGATGGCCCACTACGTGAACCATCACCCA
AATCAAGTTTTTTGGGGTCGAGGTGCCGTAAAGCACTAAATCGGAACCCTAAAGGGAGCCCCCGATTTAG
AGCTTGACGGGGAAAGCCGGCGAACGTGGCGAGAAAGGAAGGGAAGAAAGCGAAAGGAGCGGGCGCTAGG
GCGCTGGCAAGTGTAGCGGTCACGCTGCGCGTAACCACCACACCCGCCGCGCTTAATGCGCCGCTACAGG
GCGCGTACTATGGTTGCTTTGACGTATGCGGTGTGAAATACCGCACAGATGCGTAAGGAGAAAATACCGC
ATCAGGCGCCATTCGCCATTCAGGCTGCGCAACTGTTGGGAAGGGCGATCGGTGCGGGCCTCTTCGCTAT
TACGCCAGCTGGCGAAAGGGGGATGTGCTGCAAGGCGATTAAGTTGGGTAACGCCAGGGTTTTCCCAGTC
ACGACGTTGTAAAACGACGGCCAGTGCCC

FIGURE 5: Genomic Nucleotide Sequence of *Aspergillus kawachi* GSHE

ATGTCGTTCCGATCTCTTCTCGCCCTGAGCGGCCTTGTCTGCTCGGGGTTGGCAAGTGTGATTTC
CAAGCGCGCGACCTTGGATTCGTGGTTGAGCAACGAAGCGACCGTGGCCCGTACTGCGATCCTGA
ATAACATCGGGGCGGACGGTGCTTGGGTGTCGGGCGCGGACTCTGGCATTGTCGTTGCCAGTCCC
AGCACCGATAACCCGGACTGTATGTTTTGAGTTCGGATTATGAATGTGTCTTGGTTGATTGATGC
TGACTGGCGTGTCTTTTGATGATTGTAGACTTCTACACCTGGACTCGCGACTCTGGTCTCGTCAT
CAAGACCCTCGTCGACCTCTTCCGCAATGGAGATACTGATCTCCTTTCCACCATTGAGCACTACA
TCTCCTCTCAGGCAATTATTCAGGGTGTCAGTAACCCCTCTGGTGATCTGTCCAGCGGTGGTCTT
GGTGAGCCCAAGTTCAATGTCGATGAGACTGCCTACACCGGTTCTTGGGGACGGCCGCAGCGTGA
TGGTCCTGCCCTGAGAGCAACTGCTATGATCGGCTTTGGGCAGTGGCTGCTTGTATGTTCTCCAC
CTCCTTGCGTCTGATCTGCAACATATGTAGCCGACTGGTCAGGACAATGGCTACACCAGCGCTGC
AACAGAGATTGTTTGGCCCCTCGTTAGGAACGACCTGTCGTATGTGGCTCAGTACTGGAACCAGA
CGGGATATGGTGTGTTTGATTGATCGGGGTTCAAGGGTGTTTGTGCATCGGAGCTAACTTCGCGG
TCGCAGATCTCTGGGAAGAAGTTAATGGCTCGTCCTTCTTCACTATTGCCGTGCAACACCGCGCC
CTCGTCGAAGGTAGTGCCTTCGCGACGGCCGTCGGCTCGTCCTGCTCCTGGTGTGATTCGCAGGC
ACCTCAGATTCTCTGTTACTTGCAGTCCTTCTGGACCGGCAGCTACATCCTGGCCAACTTTGACA
GCAGCCGTTCCGGCAAGGACACAAACACCCTCCTGGGAAGCATCCACACCTTTGATCCTGAGGCT
GGATGCGACGACTCCACCTTCCAGCCCTGCTCCCCGCGTGCGCTCGCCAACCATAAGGAGGTTGT
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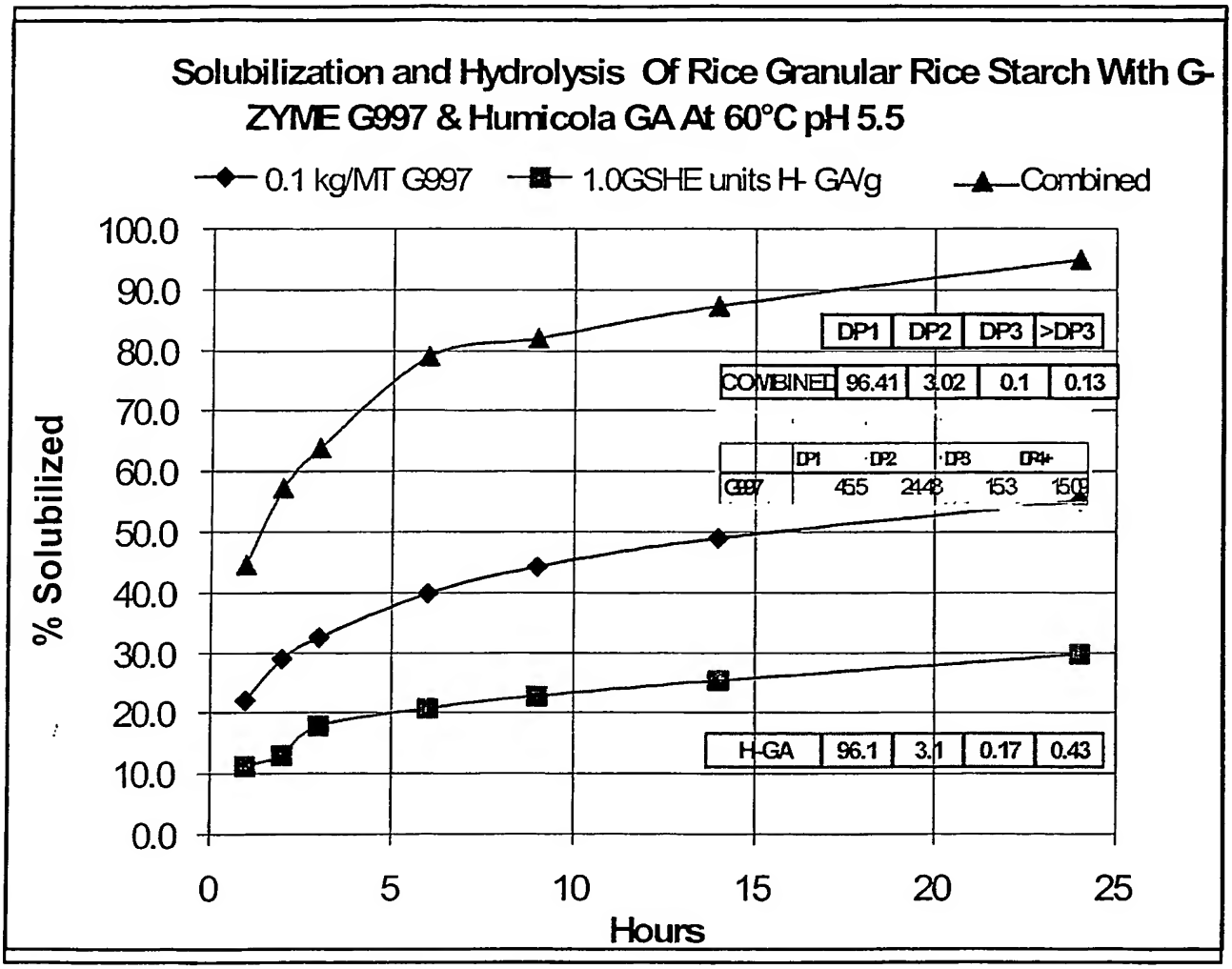
GTCGGTACCCTGAGGATAGCTACTACAACGGCAACCCGTGGTTCCTGTGCACCTTGGCTGCCGCG
GAACAGCTGTACGATGCTCTGTACCAGTGGGACAAGCAGGGGTCGTTGGAGATCACAGACGTGTC
ACTTGACTTCTTCAAGGCTCTGTACAGTGGTGCTGCCACCGGCACGTACTCTTCGTCCAGCTCGA
CCTATAGCAGCATTGTGAGTGCCGTCAAGACTTTCGCTGATGGTTTTGTTTCTATTGTGGTAAGT
CTACGCTAGACGAGCGCTCATATTTACAGAGGGTGCGTACTAACAGGATTAGGAAACTCACGCCG
CAAGCAACGGCTCTCTGTCTGAGCAATTCGACAAGTCTGATGGCGACGAGCTTTCTGCTCGCGAT
CTGACCTGGTCTTACGCTGCTCTGCTGACCGCCAACAACCGTCGTAATTCTGTCGTGCCCCCGTC
TTGGGGTGAGACCTCTGCCAGCAGCGTGCCCGGCACCTGTGCGGCTACCTCTGCCTCTGGTACCT
ACAGCAGTGTGACCGTCACCTCGTGGCCGAGCATCGTGGCTACTGGTGGCACCACTACGACGGCT
ACTACCACTGGATCGGGCGGCGTGACCTCGACCAGCAAGACCACCACAACTGCTAGTAAGACCAG
CACCACTACGTCCTCGACCTCCTGCACCACCCCCACTGCCGTAGCTGTGACCTTTGATCTGACGG
CGACCACCACCTACGGCGAGAACATCTACCTGGTCGGGTCGATCTCTCAGCTCGGTGACTGGGAG
ACCAGCGATGGCATAGCTCTGAGCGCTGACAAGTACACTTCCAGCAACCCGCTTTGGTATGTAAC
TGTGACTCTGCCGGCTGGTGAGTCATTTGAGTACAAGTTCATCCGCGTCGAGAGCGATGACTCCG
TGGAGTGGGAGAGCGACCCGAACCGGGAATACACCGTTCCTCAGGCGTGCGGCGAGTCGACCGCG
ACGGTGACCGACACCTGGCGGTAG

FIGURE 6: *Aspergillus awamori* var. *kawachi* GSHE precursor (including the underlined signal sequence and mature protein) protein sequence.

M S F R S L L A L S G L V C S G L A S V I S K R A T L D S W L S N
E A T V A R T A I L N N I G A D G A W V S G A D S G I V V A S P S
T D N P D Y F Y T W T R D S G L V I K T L V D L F R N G D T D L L
S T I E H Y I S S Q A I I Q G V S N P S G D L S S G G L G E P K F
N V D E T A Y T G S W G R P Q R D G P A L R A T A M I G F G Q W L
L D N G Y T S A A T E I V W P L V R N D L S Y V A Q Y W N Q T G Y
D L W E E V N G S S F F T I A V Q H R A L V E G S A F A T A V G S
S C S W C D S Q A P Q I L C Y L Q S F W T G S Y I L A N F D S S R
S G K D T N T L L G S I H T F D P E A G C D D S T F Q P C S P R A
L A N H K E V V D S F R S I Y T L N D G L S D S E A V A V G R Y P
E D S Y Y N G N P W F L C T L A A A E Q L Y D A L Y Q W D K Q G S
L E I T D V S L D F F K A L Y S G A A T G T Y S S S S S T Y S S I
V S A V K T F A D G F V S I V E T H A A S N G S L S E Q F D K S D
G D E L S A R D L T W S Y A A L L T A N N R R N S V V P P S W G E
T S A S S V P G T C A A T S A S G T Y S S V T V T S W P S I V A T
G G T T T T A T T T G S G G V T S T S K T T T T A S K T S T T T S
S T S C T T P T A V A V T F D L T A T T T Y G E N I Y L V G S I S
Q L G D W E T S D G I A L S A D K Y T S S N P L W Y V T V T L P A
G E S F E Y K F I R V E S D D S V E W E S D P N R E Y T V P Q A C
G E S T A T V T D T W R

Figure 7


Solubilization and Hydrolysis Of Rice Granular Rice Starch With G-ZYME G997 & Humicola GA At 60°C pH 5.5
0.1 kg/MT G997
1.0GSHE units H- GA/g
Combined
% Solubilized
Hours
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
5
10
15
20
25
DP1 DP2 DP3 >DP3
COMBINED 96.41 3.02 0.1 0.13
DP1 DP2 DP3 DP4+
G997 455 153
H-GA 96.1 3.1 0.17 0.43